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ABSTRACT

This paper, designed to be used in conjunction with a video-tape developed by the Learning in Science Project (Primary)--LISP(P)--shows excerpts from some of the interview schedules used to examine children's ideas about floating and sinking. These interviews involved the use of "interview-about-instances" (IAI) cards (included in an appendix) to examine what children mean by the word "floating," and the use of different materials (listed in another appendix) to examine several additional areas. These areas include: (1) which materials float and which materials sink; (2) a child's idea about the effect of the depth of water on floating; (3) a child's idea about the effect of the length of an object on how well it floats; and (4) a child's ideas about displacement. (JN)

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LEARNING IN SCIENCE PROJECT (PRIMARY)

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VIDEO: FLOATING AND SINKING

Science Education Research Unit
University of Waikato
Hamilton, N.Z.

SE 015 317

Working Paper No. 115

VIDEO : FLOATING AND SINKING.

Roger Osborne,
Science Education Research Unit,
University of Waikato,
Hamilton, New Zealand.

A working paper of the Learning in Science Project (Primary), No. 115.

This paper is designed to be used in association with the video tape Floating and Sinking prepared by the author.

FLOATING AND SINKING.

Introduction.

This video shows extracts from some of the interview schedules used to examine children's ideas about floating and sinking.

WHAT DO CHILDREN MEAN BY THE WORD FLOATING?

[The set of interview-about-instances cards used for this interview are provided in Appendix A].

I. We are interested in people's ideas about floating and sinking and what I want to do this morning is just have a talk to you about your meaning of the word floating and your meaning of the word sinking. What I want to use is this little tape recorder here and to let him listen to us because I probably cannot remember everything you say. If you say something you don't like we will wipe it off...Okay? Well let's turn this (the tape recorder) on...well we will see if I can turn it on...yes that's right.

Okay, that's right, okay, so we're going to just talk about floating and sinking. Now what I'm going to do is show you some pictures and we'll have a chat about them, okay?

Right...now...there we have an apple, okay? Now, in the way you think about floating would you say the apple's floating or not?

P. Yep.

I. Yeah?

P. That's right, yeah.

I. Why do you say that? Why do you...?

P. Because he's on the surface.

I. Because he's on the surface. Okay. That seems pretty simple and that's all that's in it. Okay?

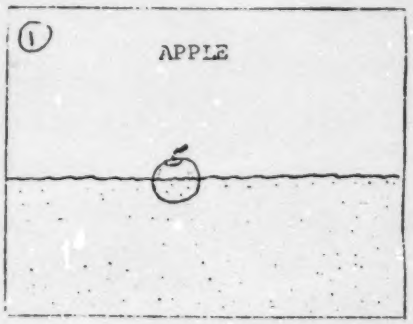


Figure 1.

I. Here's some stones being dropped into water.

P. They're sinking.

I. So they're sinking?

P. Uh huh.

I. You wouldn't call them floating?

P. Nope.

I. Nope. Okay. Why do you call them sinking?

P. Cause they're going down into the water.

I. Because they're going down into the water. Fine. I get your idea there very well.

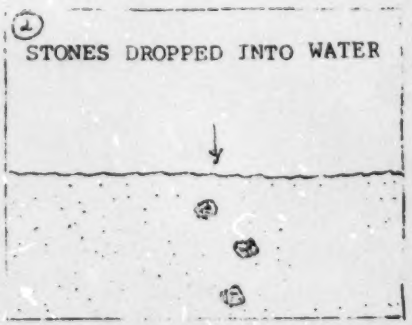


Figure 2.

That's what I'm trying to find out is your ideas about these things. Okay?

P. Mm.

I. Here's a.....

LATER

I. Here's somebod...under the water looking at fish. You know how people can,with flippers and things can,swim along under the water spear fishing and things like that? Okay, in the way you think about...floating,would you say that that person is floating or not?

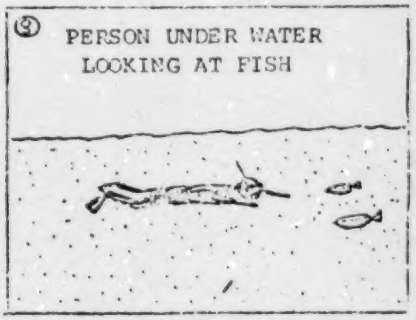


Figure 3.

P. No, cause you're under water. They're swimming.

I. Oh, they're under water and they're swimming.

P. Mm.

I. Okay...Fine. Can you explain that a little bit more to me. Why...it's not floating to you?

P. It's...it's...it's just wa...under water swimming.

I. It's just under water swimming. Okay. Good.

I. Well, here's a submarine, ah, it's in the water but it's just got its periscope showing, you know how they have a little thing...

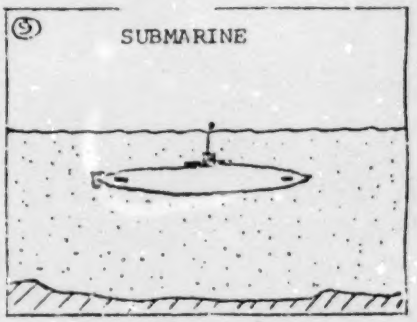


Figure 4.

P. Mm.

I. ...they can put up to see out?

P. Yep.

I. Right, okay. Now in the way you think about, ah floating, would you think that the submarine was floating or not, like that?

P. It's...just...going through the water.

I. It's just going through the water.

P. When it...when it rises to the surface it's floating.

I. Right, fine. So when it,...if it rises up to the surface it'll be floating.

P. Mm.

I. But just like that it's just going through the water...

P. Yeah.

I. ...the way you think about it...Fine.

WHICH MATERIALS FLOAT AND WHICH MATERIALS SINK.

[The set of materials used in this interview schedule is given in Appendix B].

I. Well I want to talk to you about floating and sinking.

P. Uh huh.

I. You know that some things float and some things sink don't they?

P. Yep.

I. Okay. Well the first thing I want you to do is to go through the things I've got here and I want you to put them in two piles. The pile of things you think will float and the pile of things you think will sink. Okay? [The pupil begins to form two groups]. Now can you talk to me as you do it, telling me what you're thinking.

P. [Fibreglass] I think this one would float...

I. You think that'd float. You went like this. Why did you do that?

P. Oh, see how heavy it was.

I. Oh I see. To see how heavy it was. Okay, fine.

P. [Polystyrene] That one will float.

I. That one'll float. Yeah. Why do you think that?

P. Because it's really light and...that...floats.

I. So it's really light
and that thing floats.

I. Okay. That's ah, that's strange but it's actually a piece of aluminium... metal...See...

P. [Aluminium] I think that'll...

I. It's just been painted.

P. ...sink.

I. You think that'll sink. Why do you think that?

P. Cause if it's metal...

I. If it's metal...

P. ...it'll sink.

I. ...it'll sink. Okay. Fine.

P. [Wood] That'll float cause wood...wood floats.

I. Ah ha, you know that. Did you?

P. Yes.

I. Okay. That'll float cause wood floats. All right...Do you know what that is?

P. That's pumice.

I. That's pumice. Okay. And what do you think about pumice?

P. [Pumice] I think it...oh...Sometimes it floats and sometimes it sinks.

I. Oh. Sometimes it floats...How do you know that?

P. Because I've tried it before in the bath.

I. You've tried it before in the bath. Well, where do you want (to put) it? Where are you going to put that?

P. In the...sinking.

I. In the sinking one. Okay. Fine. What's that?

P. [Candle] Ooh. It's a candle.

I. It's a candle.....What do you think about a candle?

P. .....I think it'll float.

I. You think it'll float. Why do you think that?

P. I dunno but I just do.

I. You just got a feeling about it. Okay, let's put it there.

P. [Paper clip] These paper clips...

I. Just have one. We don't really need two.

P. Think paper clip will sink.

I. You think the paper clip will sink.

P. Mm.

I. Why do you think that?

P. Because it's got holes in it and it'll just go to the bottom.

I. Okay. Got holes in it and it'll just go to the bottom...Fine.

P. [Rubber] And the rubber?

I. Yeah?

P. Um.....(long pause).....think it'll float.

I. Uh huh. Why do you think that?

P. ...Oh, because.....I dunno.

I. You just think it will.

P. Yeah, I just think it will.

I. Okay. Got that feeling.

P. And the plasticine [chalk] and the chalk...will sink.

I. Uh huh. Chalk will sink.

P. [Plasticine] And the plasticine will too.

I. Uh huh. Why do you think those two things will sink?

P. ...um. Because.....(long pause).....er...

I. Just you've got a feeling they will.

P. Mm.

I. Yeah. Okay. You find it a bit hard to explain...

P. Yeah.

I. ...why you think so. Okay. Well, I'm going to ask you an even harder question. You've got all these things here...you think will float...

P. Uh huh.

I. ...and all these things here you think will sink.

P. Mm.

I. Okay. Now can you give me a simple reason, or have you ever thought about, what the simple reason would be that those things will float and these things will sink?

P. Cause some of them are flat and I know that wood will float...

I. Right, right.

P. ...cause most wood does and...well...I dunno, and those things are kind of round or,...and things that sink either heavy or they've got holes and the...the water gets through and makes them go sink.

I. Oh, I see. Okay. So,...fine. Well that's a very good answer to that,cause I it helps me understand how you're thinking about it. Right, well do think we should try it to see if you're right or not?

P. Oh, I found out why I think the candle will float...

I. Yes, yes.

P. ...because, well, it's wax.

I. It's wax.

P. It's wax.

I. Ah huh. And what does...how...what makes you think that wax will...

P. Because when Mum does batik the water never gets through the flax...

I. Yeah.

P. ...the wax...

I. Yeah.

P. ...into the material and so that's what...

I. Okay that gives you the feeling about...

P. ...that's why.

I. Well that's good that you've been able to...think about that a bit more and work that out.

LATER THE PUPIL IS GIVEN AN OPPORTUNITY TO CHECK HER PREDICTIONS...

I. Right, well which are you going to try...which are you going to try first?

P. Ooh. I know that'll float [wood].

I. You know that'll float and you're right. Okay. Well we'll leave him over there, put it up there so...

P. And I'll try...this.

I. Uh huh. That's aluminium. Yep.

P. It sinks.

I. And you're right about that as well! That's good. Yep. Well put him over...and leave him with the sinkers, okay.

P. Okay. And that will float.

I. Yeah! Yeah, that'll float. Fine.

P. [Polystyrene] Push it under and it'll even float.

I. Push it under and it'll even float.

P. Mm.

I. Yeah!...Good.

P. Now, the pumice.

I. The pumice...

P. Oh well, it's kind of floating down and sinking.

I. Well. Tell me about that? It's kind of floating and it's kind of sinking.

P. Well most of it's under and...

I. Uh huh.

P. ...only little bit's on top.

I. Oh, I see, I see. Would you call that floating or sinking?

P. ...Both...

I. ...Really?

P. Mm.

I. So what's it? A floater or a sinker?

P. ...It's in between.

I. It's in between. Uh huh. You don't think it floats very well?

P. No.

I. Oh. Okay.

P. I'll get it out.

I. Okay. Well you better put him in the middle over here. Right. What next?

P. This. [Fibreglass]

I. Okay.

P. Oh. Ha ha.

I. That's fibreglassy sort of stuff. What's it doing?

P. It's...floating.

I. It's floating?!

P. Yes.

I. But it wasn't a minute ago was it?

P. Yeah I know. Cause it was like it was caught on there.

I Okay. Well hang on. Put it back in again...Okay, now push it under a little bit.....What's happened now?

P. It's stuck. [sticks on the side of the bowl].

I. It's stuck. Oh, all right, well take it out, it's too small for it. Put it in here then.....It floats [larger bowl now used].

P. Uh huh.

I. Push it under...

P. ...and it sinks!

I. ...and it sinks...Now what do you make of that one then?

P. It's a floater and a sinker.

I. It's a floater and sinker as well. Is it the same sort of floating and sinking as this?

P. No.

I. Different.

P. Different.

I. Well let's have another pile. Shall we have another pile?

P. Okay.

I. Okay. Righto.

P. Now I think the chalk.

I. The chalk.

P. Chalk sinks.

I. Chalk sinks. That's what you thought wasn't it?

P. Yes.

I. Right, put him over here, he's a sinker. Right, what next? What've we got left?

P. The candle.

I. Candle.

P. Candles are kind of the same as the pumice but it...

I. It's kind of the same as the pumice.

P. Yeah cause look, the pumice... [Puts pumice back in water for comparison].

I. Oh, they sort of float but a lot of it below.

P. Yeah.

I. Okay, okay.

P. They can go in the same pile.

I. They can go in the same pile. Right, okay.

LATER

I. Now that we know which of these things float and which of them sink um... could you describe to me again very simply ah, why you think all those float and why you think all those sink?

P. Well, I think this sinks because it's got big holes in it.

I. Yeah, right.

P. Like that.

I. Yep, yep.

P. And...that... I knew that would sink, I dunno why, I just did.

I. Yeah, okay.

P. But I didn't think that would sink but I don't know why.

I. Okay.

PUPIL CONTINUES DISCUSSING INDIVIDUAL CASES BUT DOES NOT MAKE ANY GENERALISATION.

DOES THE DEPTH OF WATER MAKE ANY DIFFERENCE?

[Here we investigate a child's idea about the affect of the depth of water on floating.]

I. Let's have a look at this boat.

P. My brother's got a boat like that except...

I. Has he?

P. it...it's a little tug.

I. It's a little tug. Okay, well you put it in the water and see how well it sinks or floats..... Right.

P. It's got this thing on the bottom of it to s.., keep it up but it won't keep up. It keeps tipping over like that.

I. Oh, it keeps tipping over, right. Boats, little boats, do that sometimes. Okay, now if you look al... at the marks on the side, where's the water coming up to?

P. That mark.

I. That one there, the third one along. The third one towards the front.

P. Mmm.

I. Okay. What I want to know is if we took this boat out and took it to the swimming pool, have you got a swimming pool at school?

P. Yes.

I. Okay.

P. It's all green and yuk.

I. Okay, right. Well let's imagine it's summer time and it's all nice.

P. Mmm.

I. Now it's quite deep. It's much deeper than this isn't it? If we put this little boat in the swimming pool, which mark do you think the water would come up to then?

P. ..... might come up to that one, and it might come up to that one.

I. It might come up to the same one, or it might come up to a different one.

P. Mmm.

I. Okay. What if we took it out in the ocean and waited for a nice calm day, the big deep ocean way over our heads, so it's..

P. It'd probably go low.

I. It'd probably go low.

DOES THE SIZE OF THE OBJECT MAKE ANY DIFFERENCE?

[Here we investigate a child's idea about the affect of the length of the object on how well it floats.]

I. Now let's go to this thing which you thought didn't float very well, this piece of ...candle. We'll put that in here... okay. Now you know how well it floats. All right? Not...

P. Mmm.

I. ...very well. A lot of it's under the water isn't it?

P. Mmm.

I. If we had a much longer piece of candle... would it sink... would it float further out in the water, or deeper in the water, or do you think just the same?

P. I don't know. It might sink because it might be heavier.

I. Uh huh, uh huh.

P. But it might stay the same. I'm not too sure.

I. Okay.

P. I've never tried before.

I. You've never tried before. And you're not sure what would happen

P. Mmm.

I. Shall we try it?

P. Okay.

I. You try it ...

P. Oh no, it s staying the same.

I. It's staying the same! You didn't know about that before'

P. No.

I. Right. All right, well, let's, let's ah do it with one other thing. Let's put the wood in. Now if we had a longer piece of wood do you think it would float the same. depth, or further out, or deeper in?

P. Oh. Because of the candle...

I. Yeah.

P. ... it might change

I. Because of the candle it might change

P No, no, because the candle was the same.

I. Yeah

P. It doesn't have to be the same but it might change but it might stay still I'm not too sure about that.

I. Okay. You think. Because you know that the candle stays the same but that doesn't mean that it might or it might not for wood is that what you're saying

P Mmm.

I. We can't tell just because we've done it with the candle?

P. Yeah.

I. Let's do it.. Here we go, just the same piece of wood but it's a bit longer

P. You sawed a bit off it.

I. Yeah, we just sawed a bit off it, that's right.

P. It's the same as well.

I. It's the same as well! Right, right! ..... Well, I wonder if you think that'll be the same with everything then?

P. Might be.

I. Might be, oh, might be.

HOW MUCH WATER IS PUSHED OUT OF THE WAY?

[Here we discuss with the pupil ideas about displacement.]

I. We're going to put this in here slowly and lower it down, and what do you think's going to happen? [Ball of plasticine on a wire, see Figure 5.]

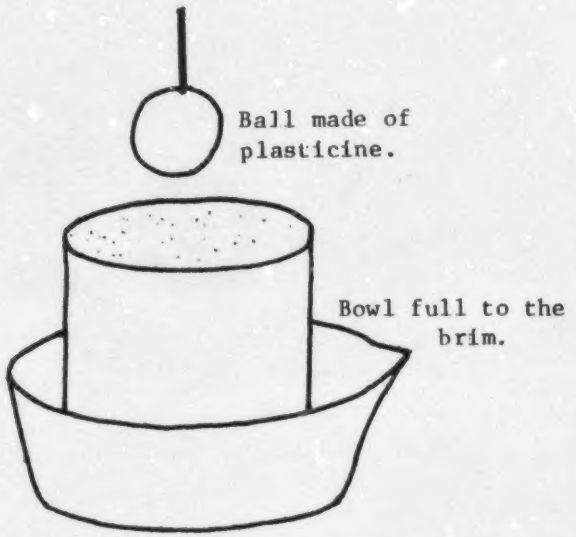


Figure 5.

P. When that goes down.

I. Yeah.

P. Um, it's like the pressure of that will make wa... some water tip... over the side into there.

I. Oh, some water will go over the side. Okay, shall we do it?

P. Yes.

I. Okay, here we go. [Trickle...splash!] Right? [Displaced water spills over.]

P. Yeh.

I. That's what you expected?

P. Yes.

I. Fine. Okay, well we'll take that water... Make sure these are empty first... and we'll put that... water which we got... into...here [Splash!] Okay?

P. Yes.

I. That's how much water...um...

P. ... came out of it.

I. ... came out of it. Fine... okay. Now we'll put that back in there and we'll top it up again..... Right?

P. Yep. [Bowl of water is refilled to the brim.]

I. Okay... Now this is... made out of the same amount of plasticine as this. You put them in each hand, you'll feel they sort of weigh about the same.

P. Yes.

I. Okay. So this is the same amount of plasticin...

P. Yes.

I. ... but we made it into a different shape.

P. Yes.

I. Okay. Now, I'm going to put this in the water too, but this time I'm going to put it in... I'm going...[Figure 6.]

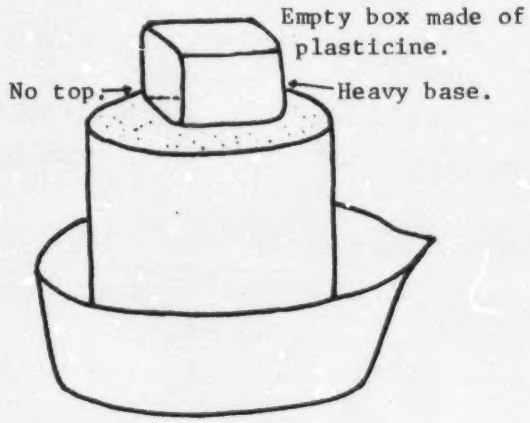


Figure 6.

P. ... Sidewards.

I. ...Sidewards, so the water can go in everywhere, okay... Now... what do you think's going to happen this time?

P. Some water will flow out into there.

I. Okay. Some water will flow out there. Would it be more water going to flow out or the same amount of water?

P. Less.

I. Less.

P. Because some of the water will go into there.

I. Because some of the water will go into there. Less than we got with this?[Ball

P. Yes.

I. Let's see how we get on... mm... don't want to drop it. I dropped this once, had a big splash.
[Trickle, trickle!]

I. Right?

P. Yes.

I. Okay. Let's take it out...mm... okay. Now, let's see how much we got this time... Now what do you think this'll be, compared to the last time?

P. Less, um, oh, about the same.

I. About the same?

P. Mmm.

I. Oh..... why do you think that?

P. Because that is the same heavy as that.

I. Because that's the same heavy as that.... Okay, well what do you think? [Much examining goes on!]
'bout the same?

P. Yes.

I. Okay, all right, fine. Now let's take one of those and, and ah, tip it out. Oh, we'll put it back in here..... 'cause I want to fill this up again.... okay? Just a drop or two more. Fine... right. Now I want to take this and I'm going to put it in here, but this time I'm going to put it in this way round.... What do you think might happen to this? The way I put it in the water; will it sink or float? Do you think? [Box with top upwards]

P. Sink.

I. Sink, okay. Well in fact we're going to find out. We'll find it doesn't sink, it actually floats... like that.

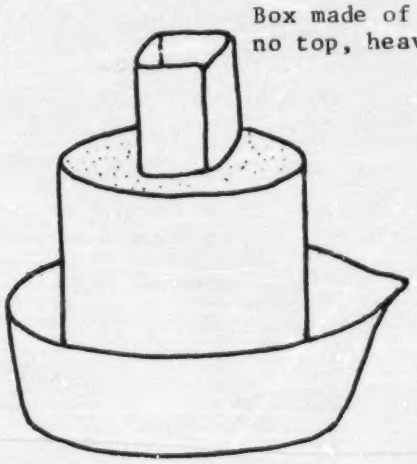
P. Yeah, but if that gets full of water. [suggesting water could go over the top].

I. Okay, but if we just put it in so it doesn't, we'll find it floats, okay?

P. Uh huh.

I. Now, when it's floating... what... er... what's going to happen to the water here... as I put this in?

P. Some of it'll spill out into there. [Figure 7.]



Box made of plasticine.
no top, heavy base.

Figure 7.

I. Okay, right, some of it'll spill out.

P. Like it did to the other two.

I. Now what I want to know from you is if we put this in so that it floats... okay, will there be more water spilling out than we got before, or less do you think?

P. Less.

I. Less, okay. Pretty sure about that? Okay, let's do it. [Splash!] It's floating, okay?

P. Yes.

I. Now, what do you reckon's happened? [Has] more water come out, or less do you think?

P. .....Hard to tell, unless you measure it.

I. Hard to tell. Okay, well, we'll have to measure it, won't we? That's fine. Take that out... take this out... and this is the one that we got from before so we want to compare it with that, right? We we'll put it in there. [Splash!]

P. There's more!

I. There's more! ...Much more.

P. There's much more than we did last time.

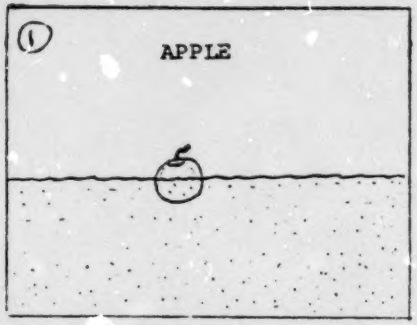
I. Yeah, much more than we got before, much more than we got before. Now I want to show you something other, something else that I think's very interesting. You put that in one hand and put this in the other hand, and tell me how they compare in weight.

P. Same.

I. They're the same! Yeah! But the amount of water that got pushed out of there is the same as the weight of this..... What do you think of that?

P. Amazing.

I. Amazing.


1
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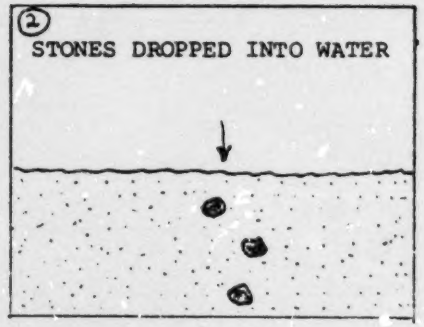
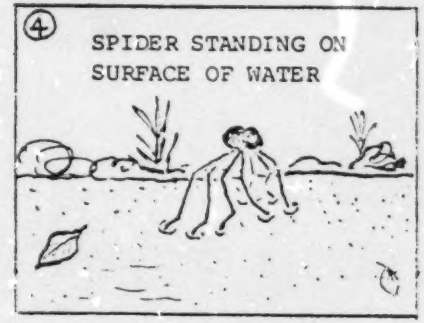
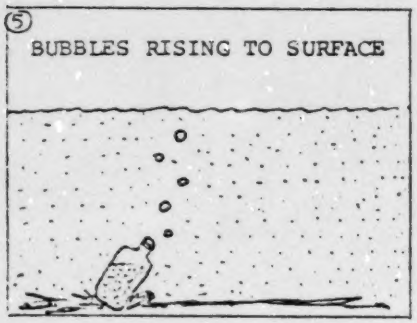
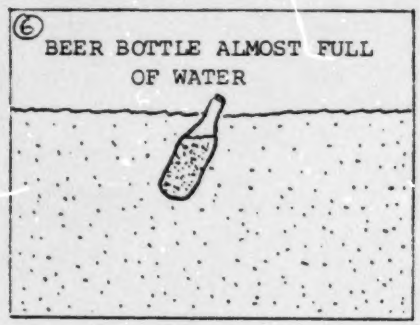
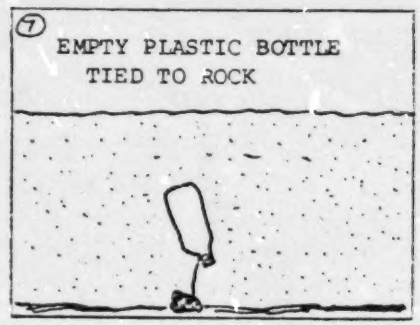

2
STONES DROPPED INTO WATER

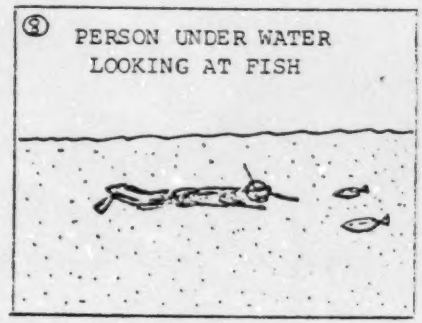
3
PERSON WEARING A LIFE JACKET

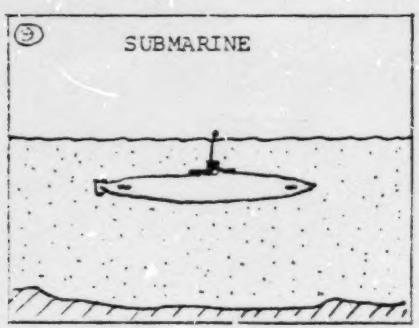

4
SPIDER STANDING ON SURFACE OF WATER

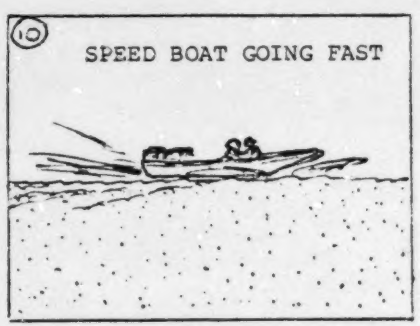

5
BUBBLES RISING TO SURFACE

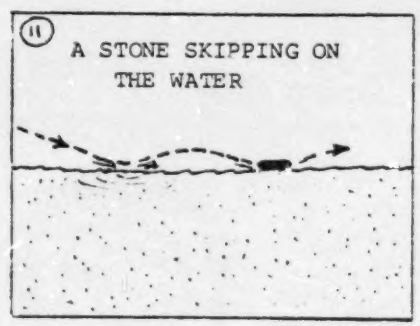

6
BEER BOTTLE ALMOST FULL OF WATER

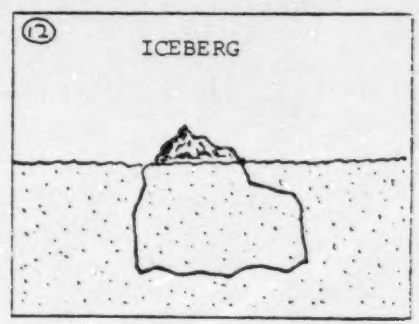

7
EMPTY PLASTIC BOTTLE TIED TO ROCK

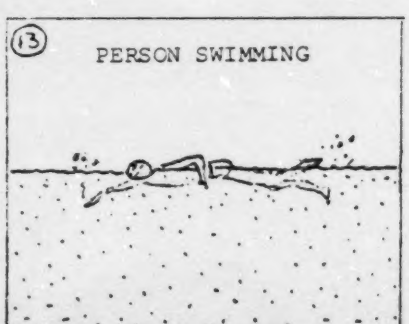

8
PERSON UNDER WATER LOOKING AT FISH

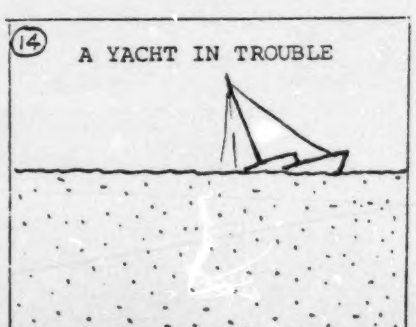

9
SUBMARINE

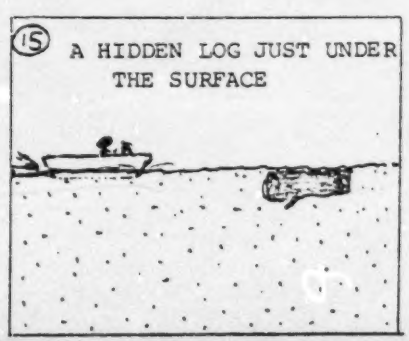

10
SPEED BOAT GOING FAST


11
A STONE SKIPPING ON THE WATER


12
ICEBERG


13
PERSON SWIMMING


14
A YACHT IN TROUBLE


15
A HIDDEN LOG JUST UNDER THE SURFACE

NAME: _____ SCHOOL: _____ AGE: _____ CLASS: _____ DATE: _____

MATERIAL	PREDICTION	REASON	OBSERVTN	EXPLANATION
Wood block				
Paper clip				
Rubber				
Pumice				
Candle				
Aluminium				
Polystyrene				
Perspex				
Chalk				
Plasticine ball				
		SUMMARY:		SUMMARY: